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occasional letter was copied with the typewriter. His social abilities were of very high order. His conversation was entertaining to the point of brilliancy. His hearers did not always agree with his point of view, which he defended with vigor and skill, but no one could be found to deny that Professor HOLDEN had made the subject seem alive. His lamented death puts former associates into the reminiscent mood which accompanies the passing of a remarkably interesting man.

HISTORICAL QUOTATIONS.

By W. W. CAMPBELL.

A recent reading of early contributions to astronomical literature has brought me upon many interesting passages which have not been used by the principal historians of astronomy, tho I since fine that some of these passages are referred to by an occasional modern writer. I venture to quote on two subjects:

(a) The idea that the Milky Way is composed of vast numbers of separate stars goes back at least to Democritus (450 ± B. C.), but KANT's *Universal Natural History and Theory of the Heavens* (1755 A. D.) appears to offer for the first time an hypothesis of the general form and structure of our stellar system substantially in accord with present ideas.

> "Mr. WRIGHT of Durham, whose treatise I have come to know from the Hamburg publication entitled the *Freie Urteile,* of 1751, first suggested ideas that led me to regard the fixed stars not as a mere swarm scattered without visible order, but as a system which has the greatest resemblance with that of the planets; so that just as the planets in their system are found very nearly in a common plane, the fixed stars are also related in their positions, as nearly as possible, to a certain plane which must be conceived as drawn through the whole heavens, and by their being very closely massed in it they present that streak of light which is called the Milky Way. I have become persuaded that because this zone, illuminated by innumerable suns, has very exactly the form of a great circle, our sun must be situated very near this great plane."—HASTIE's translation, page 30.

> "Whoever turns his eye to the starry heavens on a clear night will perceive that streak or band of light which on account of the multitude of stars that are accumulated there more than elsewhere, and by their getting perceptibly lost in the great distance, presents a uniform light

which has been designated by the name Milky Way. It is astonishing that the observers of the heavens have not long since been moved by the character of this perceptibly distinctive zone in the heavens, to deduce from it special determinations regarding the position and distribution of the fixed stars. For it is seen to occupy the direction of a great circle, and to pass in uninterrupted connection round the whole heavens: two conditions which imply such a precise destination and present marks so perceptibly different from the indefiniteness of chance, that attentive astronomers ought to have been thereby led, as a matter of course, to seek carefully for the explanation of such a phenomenon.

"As the stars are not placed on the apparent hollow sphere of the heavens, and as some are more distant than others from our point of view and are lost in the depths of the heavens, it follows from this, that at the distances at which they are situated away from us, one behind the other, they are not indifferently scattered on all sides, but must have a predominant relation to a certain plane which passes through our point of view and to which they are arranged so as to be found as near it as possible. This relation is such an undoubted phenomenon that even the other stars which are not included in the whitish streak are yet seen to be more accumulated and closer the nearer their places are to the circle of the Milky Way.

"If we now imagine a plane drawn through the starry heavens and produced indefinitely, and suppose that all the fixed stars and systems have a general relation in their places to this plane so as to be found nearer to it than to other regions, then the eye which is situated in this plane, when it looks out to the field of the stars, will perceive on the spherical concavity of the firmament the densest accumulation of stars in the direction of such a plane under the form of a zone illuminated by varied light. This streak of light will advance as a luminous band in the direction of a great circle, because the position of the spectator is in the plane itself. This zone will swarm with stars which, on account of the indistinguishable minuteness of their clear points that cannot be severally discerned and their apparent denseness, will present a uniformly whitish glimmer,—in a word, a Milky Way. The rest of the heavenly host whose relation to the plane described gradually diminishes, or which are situated nearer the position of the spectator, are more scattered, although they are seen to be massed relatively to this same plane. Finally, it follows from all this that our solar world, seeing that this system of the fixed stars is seen from it in the direction of a great circle, is situated in the same great plane and constitutes a system along with the other stars."—HASTIE'S translation, pages 54-56.

"I come now to that part of my theory which gives it its greatest charm, by the sublime idea which it presents of the plan of the creation. The train of thought which has led me to it is short and natural; it consists of the following ideas. If a system of fixed stars which are related in their positions to a common plane, as we have delineated the Milky Way to be, be so far removed from us that the individual stars of which it consists are no longer sensibly distinguishable even by the telescope; if its distance has the same ratio to the distance of the stars of the Milky Way as that of the latter has to the distance of the Sun; in short, if such a world of fixed stars is beheld at such an immense distance from the eye of the spectator situated outside of it, then this world will appear under a small angle as a patch of space whose figure will be circular if its plane is presented directly to the eye, and elliptical if it is seen from the side or obliquely. The feebleness of its light, its figure, and the apparent size of its diameter will clearly distinguish such a phenomenon when it is presented from all the stars that are seen single."—HASTIE'S translation, pages 61-62.

(b) I was immensely interested to find that Sir WILLIAM HERSCHEL had applied spectrum analysis, in a very elementary way, to six first-magnitude stars as early as the year 1798. The Harvard classification is appended for comparison:—

"By some experiments, on the light of a few of the stars of the first magnitude, made in 1798, by a prism applied to the eye-glasses of my reflectors, adjustable to any angle and to any direction, I had the following analyses:—

"The light of *Sirius* consists of red, orange, yellow, green, blue, purple, and violet. (Harvard Class A.)

"α *Orionis* contains the same colours, but the red is more intense, and the orange and yellow are less copious in proportion than they are in *Sirius*. (Class Ma.)

"*Procyon* contains all the colours, but proportionally more blue and purple than *Sirius*. (Class F5.)

"*Arcturus* contains more red and orange and less yellow in proportion than *Sirius*. (Class K.)

"*Aldebaran* contains much orange, and very little yellow. (Class K5.)

"α *Lyræ* contains much yellow, green, blue, and purple." (Class A.) —*Philosophical Transactions*, 1814, page 264.

I now find that a few authors have commented upon these observations by HERSCHEL: NEWCOMB and HOLDEN'S *Astronomy*, 4th Ed., page 468; Professor HOLDEN in *Sir William Herschel, His Life and Works*, page 196; and Miss CLERKE in *The Herschels and Modern Astronomy*, page 163.

HERSCHEL'S results for these six stars are in general correct, as tested by modern standards, tho the estimated distribution of the light of different colors differs in some details.

It should be noted that these observations, made in 1798, were not published until 1814, which was approximately the time when FRAUNHOFER'S observations were beginning.